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PRACTICAL

TILE DRAINING

FOR FARMERS.

A HAND BOOK OF INFORMATION ON ALL SUBJECTS RELATING TO TILE DRAINING.

EMBRACING IN ITS TREATISE NEW AND VALUABLE FEATURES IN TILE DRAINING.

ASHLAND, OHIO:
D. F. Wise, Publisher.
1891.

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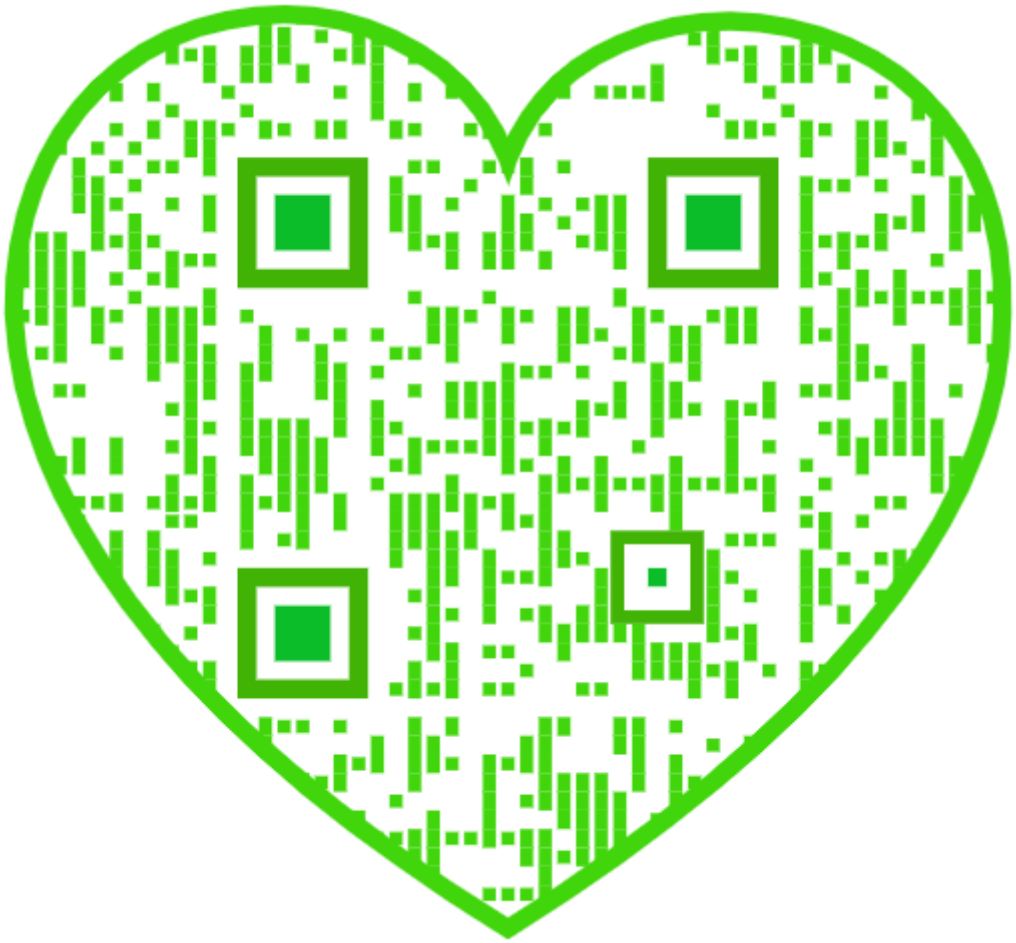

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D. F. WISE.

PRACTICAL TILE DRAINING.

In placing this little volume before the public, it is my object to not only set forth why we should tile drain, but also the best means to employ to get perfect drainage of all lands needing it.

BENEFITS OF TILE DRAINING.

In truth we may say that tiling is the leaven that leaveneth the soil into which it is placed. Tile draws the water from the soil much quicker than if the same ditch in which the tile was placed was left open. The water seems to draw towards the tile, as if by suction. Not only is it drawn to the tile, but its weight forces it down to the tile, and the smoother the tile is, the better will be the effect of the tile's working. Therefore you should, first of all, secure the best and smoothest tile possible; and if your best tile have rough spots in them, make a chisel out of an old file and cut all the rough spots out of them. Rough spots obstruct much of the flow of water by causing the tile to fill up. You must guard against this if you want a perfect drain.

Now, when tile work to their full effect they lower the water level to the bottom of the tile,

and cause a basin for water that has a slope from the bottom of the tile outward to the surface of the soil from ten to one hundred feet from the drain. Say your tile are three feet deep, then the capacity of the basin would be about nine times as much as if they were one foot deep; and about two and a fourth times as much as if they were two feet deep.

Now do not understand that this is a dug out basin. It is a basin of soil which is drained and loose and has all the unnecessary water removed from it by the tile.

Now look right here! When a heavy rain falls that basin must first fill before the crop can be flooded, while the tile is lowering the water much faster than any open draining can do. The benefits of tiling are here shown still greater. As the water filters into the tile, it leaves all of its fertility in the soil, instead of washing it away on the surface, as there is no other way for surface drains to act. Tile, by being an outlet or a great filter, as we may term it, loosens the soil so that a man accustomed to walking over tiled land can tell the moment he comes upon it. The loose, spongy condition of the soil is his guide. It is like a living soil, in pure health, with mighty vigor. The crops never fail to tell the story in large capitals, in the shape of mighty growths of grain and grasses. Let me say here that your cattle will eat the grass closer right over your tile drain than at any other place in

the same condition before tiling. If they do not, it is simply because you don't let them into the field, or the tile is not put in properly, and they may not find the location of the tiled land. If your tiling is done properly and your cattle do not find the locality of the tile after it has been down a sufficient length of time to be in fair working order, and do not prefer the tiled pasture to the untiled, I will refund you all that you have invested in this work. This fact has been fully demonstrated on my own tile drains. So I have nothing to fear in making you the offer.

Some people say only wet land is suited to stock. I know of farms that would feed one-half more stock if they were tiled, only through the swales and swamps, as they constitute about one-fourth of such farms. Think of the gain. It would increase the producing value of the farming land of this country from one-third to one-half more than it already is. If you want to raise wheat in many instances you get about ten bushels against three before it was tiled. You will also be pleased if you plant corn, as it will make the best crop that you are able to produce on your farm, and potatoes grow luxuriantly. A swamp that is loose and loamy will make you the finest potatoes that you ever ate, of the common variety that you have planted, and the best varieties are simply most excellent in quality.

In 1889, I cleared up the last swamp that I had

on my farm, and planted it in potatoes the 16th day of June, as I could not get the brush out and tiled sooner. After tiling I plowed it, but did not get a very good job done as there were many alder roots to bother me. Hence I did not get the potatoes in in good shape. But they still yielded me one hundred bushels to the acre, worth fifty dollars. They more than paid me for clearing up that swamp and tiling, and the next year that swamp was in better condition for potatoes. I planted it in new Improved Neshannock potatoes and it gave me a yield of about three hundred bushels to the acre, for which I realized one dollar and ten cents per bushel, in the market, as they are of very superior quality. Now take the one acre of potatoes for the last two years, and compare with my wheat from ten acres for the last two years. The yield was twenty-one bushels per acre. That would make four hundred and twenty bushels in two years, at seventy-five cents per bushel. We have three hundred and fifteen dollars for wheat on the ten acres for two years. For potatoes I have three hundred and fifty dollars on one acre in two years, and no threshers' bill to deduct. Now tell me! Would it not have been over five hundred fold better to have that swamp tiled than to let it remain with its brush to mar my farm and let the fifty dollars that it cost me per acre be taxed and bring me no interest? I am fully convinced that it is five hundred fold better

than to let it lie worse than idle and still stands out as a target for taxes. I was poor when I commenced on this farm, and seeing the large swamps in several fields I took them first and have kept to the work as I best could, having had typhoid fever along with the other things to contend against. I am thankful to say that I have at last mastered the last swamp, and did it in the sixth year and am truthfully glad to say that they all repaid me for the work done in the second crop, reserving half of the crop for labor of cultivating. The last swamp repaid me the first year.

I say to you, do not let those swamps keep you from farming the balance of your farm to the best advantage, but tile your swamps and add the best acres to your arable land. As long as they produce weeds and brushes they are not yours, but belong to the frogs, lizards and toads, and you are fool enough to pay tax on what belongs to them, besides, swamps are very detrimental to health and it don't look as though you cared if the world moved or not. All you have to do is to wake up and tile it. Tiling is not such hard work nor is it just so very unhealthy either, as I am none of the healthiest and I am more at ease in a tile drain ditch than I am at splitting wood. I can better regulate the work of spading than I can at splitting wood, as I sometimes get a very hard stick that gives me some very hard mauling to do.

You should always see to laying your tile so that it is done right. There is no kid glove style that is any good in tiling. You must take hold if you want the best results, and it is a work that will last a life time if done right. It will be a pleasure to reflect upon. But if done half way, why you curse your own work or allow your laborers to curse it for you. There is no work that pays so well for well doing as tile draining well done. Why it helps you every day in the Spring. It has your soil warm and dry so you can get to work early and get your crops out in time to have the start of the season. We should here remember the old saying, "That the early hen catches the bug." Your crops grow right along in full vigor.

Tiling helps you to make your crops by culture, as you can cultivate at the right time, as I said before, just as soon as you can after a rain. Tiling helps to bring the soil into the right condition to do the right kind of cultivation.

Last of all, tiling helps to make your soil moist in a dry time. Thus it helps to ripen your crop perfectly. It helps to mature you a perfect crop and the best crop your land will produce, as wet land if tiled, is in the best condition for culture and is then the richest of your soils. Why? Because you tiled it right. It will produce the best of corn, wheat, oats, grass and hay that your farm will produce. Just think of it. It will help your hay to dry as the soil under

your mown grass is in the best condition for the drying of your grass. You will need less fertilizer as you have the best of your farm producing crops to make manure to enrich the poorer parts of your land. Remember right here to apply your manure to higher lands of your farm and the drainage will naturally carry it to the lower parts of your farm, especially if it should overflow a little at times. Thus you can even the soil condition of your farm.

Tiling will do your soul good, as it will bring you a luxuriant, golden harvest. Who can help but rejoice at the golden harvest? As it is the golden harvest we have in view, let it be in the field, shop or within the office or college, store or bank. Why have hard times on the farm? Why grow poor crops every year on wet land? when you can grow the best of crops on all of your land and rejoice at the golden harvest, instead of having the blues, because you have only been able to farm half of your soil and that half not worked half, because there was a bed of water in the field, or in other words, a bed of mud that kept much of the field planted too wet to cultivate. Thus the weeds get the start of you and take the fertility of your soil and rob the crop. That fertility will not be of any use to that crop though you are able to kill all the weeds. And you cannot make manure of them in time for the crop they have robbed.

Thus if you neglect to tile your land you will

have hard times at first, because you can get more from such land well tiled; yes, enough more, often, to pay for your tile drain, and have as much left as your crop amounted to. You can do more to remove hard times than if you sit on the fence and talk tariff reform or plead for reduction of taxes, or if you get into a political quarrel about something that you know practically nothing about. Or if you did, you might be on the other side. Sometimes some farmers think they must control money making by legislation and never try to do anything but growl at others' mistakes, saying I do not make such mistakes and would be ashamed of making such mistakes. Why do they never make such mistakes? Simply because they have become a chronic set of lounging growlers always and forever dissatisfied, simply because they do nothing. If they would improve half of the time they lounge away they would then have more rest then they need and be happier men; and their women would enjoy themselves better. I know of no other way that such farmers can take than to tile their farms, instead of wasting their time in worse than useless hitching up and driving to town once, twice or even three or four times a week, when they have no business in town, except simply to hear the talk of the slums and to drink the polluting liquors, and be degraded and drag wife, children and friends down to degradation. Let me here say to you, stay at home;

drain your farm; help yourself to comfort; let your wife enjoy your company; and enjoy the comforts of life, as you promised to remain faithful to her in all adversity. It is your duty to make home the best of homes; and to do this you must make surroundings to serve you to their utmost. To do this you must tile drain all land that retains too much water or holds water on its surface. If you have but a small lot the more important it is to you that its producting capacity is the greatest that can be made, for then you will see that a little well done repays much better than much half done; and it will prove a joy and comfort to you.

Those who have large tracts of land can stand it better in one sense, and in the other not. In the first sense they may have enough to do them and lay by some without tiling; but if this is the case, should they have any license to compel poor men to work their land on half pay and spoil their farms by letting cattle tramp them into mortar beds, simply because they are too stingy to buy tile and drain their farms? No.

In the second sense their farms return them poor interest for capital invested, and taxes paid thereon. I for one say, tile your land; but don't run in debt for both land and tile and expect to make much headway in paying up from the proceeds of the farm, as the interest and debt may be too much for you to manage. If the farm is large, you may do this on quite a small piece if

you purchase cheap enough, so that you can see your way out by some other way than from the proceeds of your land alone. But if you are close to some good market you may easily find your way out by producing the vegetables that are in demand at all times in that market.

TO FIND THE DEPTH AND GRADE FOR DRAINS.

How shall I find the depth to which I can grade my ditch? The way I find how deep I can go is by using a carpenter's level. The first thing you do is to place the level on the bottom of a nail keg, turned bottom side up. Shift this keg till your level shows that it rests level. Then look over the top of the level at some object at some distance and have some one to mark the point you looked to when looking over the level. Then turn your level and look from the other end of the level. Look to see that the spirits show level and if upon looking over your level it points to the same place it did in the first place then your level is correct.

Now take a ten-foot pole and a rule, also your level and your nail keg, and proceed to the place that you want to place your drain. If you start at the upper end you set your nail keg at some spot to start that is on a fair level with the land all around it. Lay your level on the keg then shift your keg until it is level. You must bear in mind to have your level pointing down stream. Then measure the height of your nail keg and

level, then have some one to take the ten-foot pole and start down the course of your drain to some suitable spot. Look over your level and have him to mark where the top of your level points to. Then take your nail keg and level and go and set it directly over the place where the pole was set, then take the difference of the point marked on the pole and the height of the nail keg and level and if it is marked above the level of the keg and level that will be the fall you will have in that distance. Continue thus until you reach the outlet, making a record every time you level and take the measurements, in which way you can easily determine the possible fall you may have.

Now to tell you just what fall you should have would do some an injustice. But if I could do no better I would run a tile for eighty rods on a level, if I could then get even a two foot outlet that is two feet below the surface. You will see that the water would press down two feet all along that tile drain and I could see no difficulty in such a drain working well if made of smooth and uniform tile. I should prefer the best glazed tile for such purposes, as they would offer less resistance to the flow of the water.

But do not understand me to say this is desirable. It will do under the pressure of circumstances. I would prefer one inch to the rod, but that can not always be had.

DRAINING SWAMPS.

There is also such a thing as draining a swamp that seems to be in a deep basin, by drilling down through the hard-pan into the ground or sand bed below and filling the holes with tile or gravel to allow the water to go down. But tile let down will do better, as tile can be run to them, then, or you may make more holes by drilling to the sand bed below and fill them with gravel. Sometimes you can drain by digging into the hill and strike the gravel bed. Several feet in such a gravel bed would be sufficient by laying tile back from there into the swamp.

Here let me say, if you drill the holes in the swamp to reach the gravel bed for drainage, you can protect them from filling up, by digging a trench about the hole several feet long and about sixteen inches wide. Here make a brick trunk, close up by inserting tile in several places to admit the tile branches to be constructed. Remember to make the trunks with solid bottom but use no mortar in making your trunk, and cover it deep.

Practically all land having no deep gravel bed in direct connection with the surface soil should be under-drained with tile. Such soils many times hold water in them too long, thus causing imperfect growth of our best cultivated plants. They first become root-drowned, and the roots stay on top of the soil, and when the water dries up, the soil around the roots becomes so

compact that the plant starves for the want of soil airing if not broken up with cultivation. There are practically speaking only a few plants that we generally cultivate during their growth, as most of our land is generally in wheat, oats, barley, flax, rye, or grass; and if we are desirous to succeed fully and satisfactorily we must tile all such wet land, as then it will be but a short time until we can cultivate our crops after a rain. The sooner the cultivating is done after rains, but not in mud, the better for the growing crops; as the cultivating breaks the crust of the soil and allows the air to act on the loosened part of the ground, which then acts as a mulch or covering of anything that will keep the soil from breaking up or cracking apart, and cramping the roots in air tight blocks of clay.

Tiling in this case helps you to air the roots of your plants that they may grow. The loosened coat on top helps to hold sufficient moisture and store nitrogen from the air, as air passes through the loosened soil to the tile below. Manure or the fertility of the soil is not lost by the evaporation of water from the soil as the cultivated surface acts as a blanket keeping the temperature even.

Again I say that tiling well done, helps to save your crops from drowning out; saves the ammonia of the rain water as it passes down to the tile; saves the ammonia of manure and of the soil; stores nitrogen

in the soil by the soil being kept covered with the natural grasses instead of weeds that simply rob the soil as the slovenly, thoughtless farmer or the stingy miser who seeks to take off only and make no returns to his soil. Greed, in this case, often cannot see that treating the farm intelligently pays. It cannot see a return of interest and principal unless secured by ironclad notes and cutthroat mortgages.

Tiling makes you less weeds to rob your soil of its fertility, as it gives you a chance to cultivate your soil in time to kill the weeds. Tiling also helps to pulverize your soil so that weeds will not spring up from the clods that could not be pulverized on underdrained soil. Also weed's seed require quite an amount of water to make them germinate. This they get on all land that is flat and not tiled, while on tiled land the seed of weeds do not get watersoaked and do not spring up by millions.

We should drain all soils that can be made to bring a fair crop by tiling. I would not advise to drain large flats of very poor clay soil, as it requires on such soil a very expensive net work to tile them. But if you think that you can better your soil enough to produce profitable crops, which you can easily and cheaply determine by draining a few acres as a test, then drain all; but mind and have good outlets and perfect grades before laying your tile. Then you can prove what tile will do and only then.

Please remember that I said that I would not tile drain very large flats of poor clay soil. But if they are small ones don't let them mar your farm. Drain them as they may be rich in elements of fertility when opened to the air with tile. Some of the large flats of supposed clay soil may be rich in elements of fertility when opened to the air with tile. These large flats of supposed clay soil may be rich in the elements of fertility when made dry enough that they will bring crops, or as soil should be to bring crops. But let me here state that in many cases it would be cheaper to buy a farm in a good state of fertility than to drain a very poor clay farm.

Do not understand that I say, by any means, high prices. There are many farms sold at moderate prices that naturally have good soil. Such farms that have once produced good crops but now fail because of having been wrongly treated, and are still being treated the same, these farms may have a few wet spots, winter springs or swales or sloughs that you may profitably drain, and then you can raise good crops on those places and the rest of your land can be brought up by raising clover to cover your ground, thus forming a mulch for the retaining of nitrogen or the storing of nitrogen from the air; also holding the ammonia of the soil under the bed of leaves with which the soil will be covered from a well set crop of clover.

Do not, if you want the good of your clover, let timothy grow up and devour all that the clover has done for you, and make the soil stiff and poor as many do, thinking that the clover runs out and the timothy does not. Your soil will run out in timothy, but can be restored with clover. Remember that clover only lives until it produces its seed and then dies. It is with but few exceptions found dead at the end of the second year. Then is the time to turn it under, as then you get the good of the roots, of their fertility also. The more of the tops you plow under the better, as then you leave your soil in a good condition for the following crop. But do not think that you can raise three or four crops before you return clover to it again. But get it back to wheat as soon as you can so that you get it in clover again. Sow your clover early and plenty of it; also some timothy at the same time, or a little earlier. Then when you have a good set of clover do not turn in your stock to gnaw it down to the ground, thinking the great mistake as many do, that if it grows nice that it is a dead loss if your stock does not get it to eat. But I say to you let that clover grow up some, but before the weeds get much of a start take your mower and mow stubble, weeds and all down to the ground, and the stubble, weeds and clover leaves, all help to mulch the ground and keep your soil from drying. If you do this you will see your clover make

a thick set of leaves, spreading out over the ground. It feels good, as you have killed many of its robbers and many of your robbers—that is, the weeds. Your clover gets what the weeds will take and grows strong and stalky instead of puny and spindling stuff, as when choked and robbed by weeds.

If your clover should grow too rank, as it does sometimes, you can mow it down again, but not as low as it was the first time. Never let your stock gnaw your land brown and bare, if it is farming land, as such soil becomes hard and poor by such treatment. Properly speaking, it is the way all soils are impoverished and even tiled land, tramped, don't drain well or half drain. Why I speak of clover as I do, is because it not only enriches your soil and loosens it, but helps to drain your soil—helps tile to drain by loosening up the soil. Take this into strong consideration, that land, where clover can never be made to keep a good stand on account of constantly freezing out, must tile or you can never reclaim it.

HOW TO DO TILING.

The first thing in starting a tile drain is to have a short spade with which you can cut from eight to nine inches deep. In making this first cutting, you must grade your fall, as then you can use the water with the least work to level your ditch if you clean your ditch as you go and

make a perfect even bottom in it, so that the water flows evenly and freely. You can then use a narrow, round pointed spade, the shape of your tile. Use this spade as a measure. It should be an eighteen inch spade and if you will put your spade down the same depth every time, the bottom of your ditch will have an even grade. Clean it out often and be sure that your work is right. Do not make a lot of ditch and leave it open, but always lay tile in all your finished ditch as soon as done. Then no rain can hurt your ditch, nor any thing else happen it. If you cover your tile and shut the end tile with a brick, then no mud can be washed into it.

The first opening or grading should always be done somewhat considerable ahead of the last spading. Go ahead far enough so you may be sure that you can go a good depth along your ditch. But if you have rooty land, that is new ground, you want a square pointed spade, as a round pointed spade will not cut roots. If you have no tile scoop and have an old crosscut saw blade, take it to the blacksmith, remembering to have your pieces cut as long as your tile, but better fourteen inches long, than just the length of your tile, and take a tile along and have him bend it around or half way around your tile.

You should get an iron fastened inside of the scoop and at one end so you have the use of the scoop. Fasten this iron in a good strong fork

handle in such a shape that you can stand on top of the ditch while cleaning it out. It is not necessary to get in the ditch and muddy yourself if your scoop is set at the right angle; and it is not near so hard work as to cramp yourself in a narrow ditch, besides avoiding the wetting and muddying of your clothes.

Then your scoops will make a ditch in which your tile, if rightly laid cannot move or be moved. Round tile are the best as they make the best fits. Tile should fit closely and don't you let any holes in the bottom of your tile. Always turn them up and cover them with pieces of tile. Just so sure as you let a hole in the bottom of your tile drain the first crab that comes up the drain will go down that hole and fill your tile; be sure that you leave no gaping cracks between tile, but cover them with pieces of tile or pieces of crocks, dishes, jugs or flat stones. When you have this done cover your tile. Right here let me tell you, not to throw in the clay or mud that you took from the bottom of the ditch, but spade down lightly of the top soil to fill your ditch a little more than half full before you put that in the ditch which was in the bottom. This insures you the best drainage you can get. I made the mistake long ago of putting the soil on top and that which I took from the bottom in the bottom again, and tile three feet deep did not remove the water at some places for two days after a rain. That bottom

mud sometimes seals your tile. It did so in my case.

Some are in the habit of putting straw on the tile first; this is useless, and when covered with sticky clay makes it still worse than useless. Straw still helps to seal your tile as it packs down on the tile still worse. I have hauled gravel and put a load into the ditch at intervals so as to get surface water from heavy rains to reach the tile sooner. Another advantage you have in filling your drains with gravel is that you can always know where your tile is if you want to make new branches. The best way is to haul a load where you may want to make your branches and slightly hill it up. The best thing you can do if your swale is liable to wash, is to use gravel and make a dam across your swale that will prevent washing.

Should you wish to drain a deep slough that is subject to deep washes, you must then make large dams of stone often enough to keep tile from being washed out. This depends on the amount of fall there is in the slough and you must make trunks above those dams to receive the water more freely. These should be made of brick and the bottom of the trunk should be on a level with the tile. You should remember that there must be a solid bottom in these trunks as the crabs might work mud into the trunks. Slate or cistern cement would do on the bottom. Then start and build your trunk of brick, say

several feet long. As you build it, cut your brick at each end so that the tile will fit in as a stove-pipe does into a chimney. Build your trunk several bricks high, leaving enough space between the side walls so that it will hold several times the amount of water the tile does. Cover the top of the trunks by laying on bricks. If they reach an inch or more on the side walls it will be enough if they are good strong brick. A double layer on top would do better, if it comes near to plow depth. But with the stone dam below, the wash will soon cover your brick still deeper. The object of this brick trunk in a tile drain is to let the water into the drain much faster than it otherwise could be done. Gravel put above the dam on the brick would still be an improvement on the drainage.

Another advantage to be gained in the trunks is similar to letting air into the upper bung of a barrel when the lower one is open, causing the water to escape in full flow. Thus the tile will flow to their fullest capacity.

Brick trunks should be made where tile passes through a basin where water lies in for any length of time. They will air the drain and cause the water to flow much sooner than it would otherwise. This, with a gravel covering would be of much value in winter when the ordinary soil is sealed with frost.

If you have had your tile properly laid and you find that there is such a clay bed that it

does not admit of good drainage the brick trunk is what you must resort to, unless you can get gravel to make frequent water draws.

DRAINING HOLLOWS.

In draining hollows that are liable to much wash at every flood when the ground is in cultivated crops, there will always be trouble from tile washing out, or all the soil being washed away which is in those sloughs or hollows; and also the fertility of the wash from the hills or watershed that flows into the hollows. I will tell you, that unless you have the stone dam, you can not avoid the trouble of flood washes whenever the swales are plowed up. But there is still, I think, in many cases another way that will answer equally well to tiling. That is to plow up those hollows and take a road grader and grade them so as to be of an equal width everywhere from the center. That will leave you a nice and wide water-course in the center of your hollow. This can be made very easy if you commence to plow on the outside at an equal distance from the center of the hollow. Thus you will have a wide furrow to start with and if you roll and harrow the ground several times before you commence to use the road grader, you can do much better grading. Now after you have graded the swale, you should make short stakes of boards and drive them into the ground across it. Drive them clear into the ground and close

together, so that the water cannot wash deeper. If you follow up the hollow and drive stakes often enough your hollow will have to stay as you left it, and to protect the sides drive several stakes into the plowed ground deep as is necessary to get a very firm hold. Then take boards and sink them down on the up stream side of the stakes. Sink them down as deep as the level of the ground. Nail them to the stakes so they cannot be washed out. If you have not the boards, other timber may do, but should be several thicknesses. Place all the dirt taken out to place timbers, on the upper side of timbers or boards, tramp it very solid, as it is the solidity upon which work depends. Now when you have gone up your hollow and driven stakes in the center and made your side wings, often enough, as in this case you must use your own judgment as no rule can be given as fall varies so much, and even in the same hollow.

Now you are prepared to sow your land in some crop suited to sow grass with. But don't spare the grass seed. Sow clover, timothy and red-top very thick and you will be sure to get a set of grass, and that will insure you one of the best meadows on your farm, and it will be in such condition that you can drive in and mow it with your mower, if you have taken the proper caution to grade your ground properly. You then have a wide, even swale that will not wash easily and cannot wash if you drove

your stakes right, and made good side wings. Thus you can use your mower to mow those sloughs even if your field is in wheat or corn or oats. I mean to leave the swales for meadow instead of plowing them up, and you will find them the best of meadows, and you will not be troubled with washout ditches that you cannot cross. Your meadow will not want much for manure as the hillside wash, caught in the grass, will always supply it. If the field is in grass it can be cut with the balance of the field, and I think it would be a blessing to have the swales crossable rather than to have them full of washouts, over which neither mower, binder, or wagon can safely cross.

Should you need tile nearer the summit, you must have a stone dam across the hollow and have your outlet in this stone dam. You can build your outlet of stone, if you have good flat stone. If not, use brick or jointed sewer pipe.

BRANCH DRAINS.

Now we will go to the branches. You should have tile that are prepared with junctions. If you have not, pick a round hole in your tile just the size of the branch tile. Cover all cracks well with pieces of tile, then cover up so as to prevent them from being moved. Remember that a three inch tile will hold two and one fourth times as much as a two inch tile. Tile are to each other as the squares of their diameters.

Yet you may often add several two inch branches to a three inch tile, as a three inch tile is estimated to drain the water that falls on two and one fourth acres.

Now we will go to the upper end of the tile drain. How shall we finish it? Why, go to work and let the last tile into a small brick chimney just as you would put a stove pipe into a chimney. Let this chimney come as near to the top as you can so that the plow will not disturb the top covering bricks. This will let air into your tile and the flow will be much better than if you shut it up tight with a brick at the end tile, which you must do if you do not want your tile to fill up at the upper end. Use a mixed material, if convenient, for marking, use plenty of it. Gravel would be the best to cover the chimneys or trunks with. This also marks the locality of your tile drain. Right here let me say you can tell better where your tile drain is than nine-tenths of the men can with a surveyor's plot, by simply placing or scattering a lot of finely pounded brick or broken white dishes or broken crocks. Either will be fine enough to not interfere with your mowing machine. But you must not shut up the tile that enters into the brick chimney. This brick ventilator must not be laid in mortar, but should have a solid bottom of cistern cement, bricks or flat stones, slate or glass to keep the crabs from shutting up the tile from below. Cover it well

with bricks or flat stone to keep loose dirt out of the ventilator.

These pieces should be put on the drain when shut up. They will mix into the soil and your tile drain will always be marked, even should your surveyor's plot be lost or burned. Gravel will also do to mark the locality of your drain. Mounds of earth will do for some time but will not always be a landmark. Never fail to mark the place where you stopped laying tile, as you may want to commence there some time, and if you mark it well you can find it in twenty years as well as the day you marked it; and it will never interfere in the least in your working the soil.

Some mark with stakes that rot away soon; some mark with stones and they are always in the way. I will here say if you start at the outlet of your tile drain you will have no trouble in marking it to the upper end by using broken bricks as a mark, by placing about one-half bushel of broken bricks into your tile ditch when you are covering the tile. These should be placed into the ditch at each curve and then you can stretch a line from one lot of brick to the other and thus you will never be at a loss to know where your tile drain is, if you should ever want to put in a new branch. These bricks should be pounded so that the largest pieces will not be larger than walnuts, and should be placed so as to show on top of the ditch and

need not be placed deeper than one foot, as that would be deep enough to make a good mark. These pieces might be mixed for a couple of feet along the ditch. But be sure you put a good mark at the end of your drain, as it is for your convenience to know at any time where you laid the last tile of every drain.

LENGTH AND SIZE OF TILE.

Tile used in deep hollows should be longer than one foot. They should be two feet long. In Switzerland they use three foot tile. Tile used in such places should have joints to connect them that they may not be displaced by a heavy freshet in the spring. They should have the stone dam protection as afore described.

Where tile are expected to discharge quite a lot of water very rapidly they should be correspondingly larger, many times twice the ordinary size, and where it is shed rapidly from hills, we say three times as large as would be required to carry the water from flats.

Again, if you are in a flat valley where water is carried away in a ditch, your tile that leads into these ditches must be considerable larger than if they emptied into a natural living stream, because floods may be kept up much longer in some than in others. But in ditches having little fall, water flows slowly; hence your tile entering in such ditches must be larger than usual, for when the water begins to fall in your

ditch then your tile will do their work quickly. This is the reason why many persons who put in small tile have to take them up and put in larger. In such cases try to get some information from those that have tiled in your locality —the size of tile, the depth put down, and the working effects. View their position, compare your situation and you may act safely and wisely.

If you get your tile drains with a perfect grade as before described, then use the best tile you can get. They should be smooth and even inside. If they have any rough spots inside, cut them out with an old file ground to an edge, or chisel shaped. Lay the tile with no holes in bottom, covering those on top with pieces of broken tile. Remember right here to do your work right, is to have the satisfaction of enjoying a reward for life, and posterity for time to come, for having done a good work in good faith.

Many swamps require drains to be put around the entire swamps and through the body of the same wherever there are depressions that hold water.

Winter springs require a complete surrounding of tile, and many times, numerous branches through. Tough clay that is inclined to winter-spring can be helped much by tiling, but I have one on my farm that did me little good until I used phosphates, after which it brought me the best crop that I ever had. I have raised three

crops on this land with phosphates, which have yielded better than the heaviest manuring ever did on it. But I will not say that if I had applied lime to this sticky, sour, clay soil that it would not have had an equal effect to the phosphates. But I must say that the last of the three crops was the best of all that I raised, with a heavy set of clover in the bargain. I can say in this case phosphate helped me to raise a heavier crop than I ever was able to raise on this land after tiling.

This was part of a basin leaning to a swamp probably a fall of from three to five hundred feet to the mile. It had sufficient fall to drain any soil naturally, but the sticky nature of the soil of this water shed I think is now partly dissolved with the action of the phosphates, and I think that if I keep stock from tramping it, and plow the second crop of clover under, seed and all—understand me that I mean to mow that field then let the clover come up for seed, and then let it cover the ground till spring as a mulch then plow it under for a spring crop, as there is some blue grass that must be worked out, and a spring crop is the best for that purpose, before sowing to wheat. Whereas, should I plow it for wheat without first killing out the blue grass, it would choke the wheat out and so take possession of the ground and make it impossible to raise a crop of clover, and this would entirely shut off all crop rotation, as the blue grass

does not do much more than to fool stock for a while in the spring, and then when the dry season of the year comes it is like the darkey's flea, it "aint thar," and yet when it once has got full possession of the soil it drives out all other grass plants; and I think it also helps to bind such soil to make it drain less instead of loosening it.

Here let me say if you want to drain your soil perfectly, let plenty of clover help you to keep the soil loose. It is the best of help, and it is help that pays you.

See here, if you are troubled with plantain all you need to do is to sow heavily with clover and timothy. Sow your timothy about midwinter, your clover in February or early in March, remembering to sow heavily. But don't let your timothy grow for a year or two after your clover is run out as that will more than discount the good the clover has done towards loosening the soil and assisting in drainage.

Some people think they must have timothy hay anyhow if it will even rob the farm, just because they have and because hay buyers all want it. Cut your clover when it is in full red bloom, not when the heads are half brown, as the rule of old is. If you mow when in full red bloom you get all the sweet in your hay that the grass will ever have. If the weather is rainy, on the afternoon of the first clear day, mow if thin, and in the afternoon of the next day rake into winrows.

But should your grass be very heavy you must ted it on the forenoon of the second day. But I have never needed to ted when it made even two and one-half tons per acre. I always raked it the afternoon of the second day, turned it next morning after the dew was off. I turned it over so as to bring all loose scattering parts of the winrows into good shape for pitching; then I proceed to haul it to the barn as fast as I can.

If you have any old hay or straw take it and cover your new hay every evening with a thin layer of your old hay as it helps your old hay and keeps the cold night air from condensing all evaporation on your new hay.

You had better close all openings about your barn except the ventilator and keep the cool air of the night from condensing the rising vapor upon the new hay. Sometimes you can haul in your hay the second day if the weather is very drying. Treat your hay thus and you will have the best kind of hay, and you don't need to feed any grain in moderate work and when not working, need feed no grain at all. I thus speak as I know. There is an opinion and a misleading one, too, that clover hay is not equal to timothy hay. It is even better, and with clover and timothy thickly sown you can at least make your hay half your ideal. If you sow mammoth clover it will ripen or bloom when the timothy is at its best. Why I have said so much about clover hay is to demonstrate to you the value of

clover hay from my own experience, as a fodder, and the necessity of clover raising to bring your soil into the best draining condition possible. It loosens the soil. Now don't think you must mow your grass to the ground, but leave good stubbles, for you cannot make your stock eat much of butts of the hay, and often they leave much of the stems, and would about as soon eat so much wood. Why not leave it on the field where it will help to cover your soil and keep it loose. Here let me tell you don't cut your wheat low but cut it high, and leave all the stubbles on the field you can, to cover the ground and keep it loose and make your soil drain better. Mow your stubbles, weeds and all, down soon after the wheat is taken from the field. It will help your clover and help to loosen your soil and store nitrogen and help to tile drain your farm. This is why I say so much on this.

DEPTH OF TILE DRAINS.

You may want to know to what depth I put tile down. I put some tile down three feet eight years ago and there are some places along that drain that the water does not get down to the tile in time to produce potatoes, right over the drain. Nor does it drain until most of the water has flown down the drain several rods. Now all that I will have to do in that drain is to dig it open down to the tile, and fill the drain with gravel and bring branches of smaller tile nearer

the surface and then they will drain more rapidly as they will be above the sticky clay bed and then there will be no trouble about all the necessary drainage. Could I not get gravel to fill those drains after digging them open I should resort to the brick trunk as before described, and thus I would bring the drainage nearer to the surface. The occasional gravel fill or the brick trunk placed in those places will help you to drain three feet deep even in such sticky soil. It is very seldom that you find more than forty feet of it on one drain, though in the drain mentioned it was probably one hundred and twenty-five feet, along that drain in several places. You will find that in making a three feet drain the last foot of depth costs as much labor as the first two in many places. They put tile only two feet deep and it proves very good. And in some place where they have a very close, sticky clay soil, tile are put about twenty inches deep on an average, and they say that is the right depth for them. From experience of my own, I can say there are some places along my drains if I did not open the drains and make gravel fills, I am satisfied that there would never be such perfect drainage on some of the drains as there are on others where the soil is more porous. But let your drain be where it will, in filling, don't put in straw, but spade the surface of the sides of your ditches on the tile first then put on the ground thrown out of the ditch to fill

the balance. It will then be on top of the ground where frost, sun and rain can dissolve the sticky clay; and by spading down the surface you have a loose mold on your tile, and you have widened the sides of your ditch by giving it slope to the tile.

There is another rule by which you can govern yourself as to the depth that you should lay your tile with a prospect of their working well or working perfectly. That is this: the nearer you are to a running stream of considerable size, where there is quite a considerable gravel or drift deposit and you want to drain only an occasional basin or swale, then you can go as deep as your outlet will let you, or as deep as you wish to go. Remember to keep an even grade at all times. Should you have much fall, it is equally as important, for then it will save washouts in floods. But for such places, longer tile with joints and stone dams over the tile to break washes, are neccessary. Right here remember as you go up the stream and where water flows slower, the condition of the soil is often not as good for drainage as lower down. Then you must not put your tile as deep, or you can put them as deep if you make the gravel fills often as necessary. But you must bear in mind to have the same effectual drainage that you are able to get further down stream, you will have to exercise greater care in constructing your tile drains. The further you go up stream the greater care you must take, and on the summit you

should first secure a good outlet, then keep as deep as water will flow out of the outlet of the drain. But if there is a very sticky clay soil, you can not drain as deep as further down the stream. But, sometimes, on the summit there are some very porous flats of clay loam that would drain much deeper than one would think they would. Such loams have sometimes a mixture of bog or some irony formation that seems to have a grit in it when the spade is passing through it. Such soil generally drains well. Let me say that tile draining, well done, is done for life, and to do it well, the first thing is to have a good outlet. After you begin to lay your tile or are ready to lay, you should first lay a good brick outlet large enough to carry the water of the tile. Lay these bricks in cement mortar. These bricks should be burned hard enough to be frost proof. Your brick outlet should be several feet long, and closed over the tile solidly. You should place a wire screen in your outlet to prevent animals from entering the tile drain. Why I say you should lay your brick in cement mortar is that nothing can displace them easily and spoil your outlet which would be a damage to the whole drain.

Some make their outlets of sewer pipe, using several pieces. This will be all right if you can hold them to their places and no water dams into them to freeze them to pieces. If you use such you will have to hold them with stone and cover them so they are fully protected, or you will

have trouble. I have used wooden boxes for outlets but they cave in before you are aware, as some side or the top will rot and down goes your trunk, and it requires much time to look after them and keep them in good repair, and if made of good lumber they cost quite a considerable. So I think for me there shall be no more wooden outlets.

WHAT TO USE TO DRAIN OR UNDERDRAIN OUR SOIL.

The very best burned tile that we can get. Glazed tile are the best, as they generally have a smooth inside, which is very important to have, as it lets the water flow more freely than it will in an ordinary tile, as they are somewhat rough and retard the flow of water very much; and many tile have blisters inside which must be cut out before laying. You had better throw such defective tile away rather than put them in. Without cleaning they will only choke your ditch or reduce the capacity of the drain. Some say rough tile let water through the body of the tile. I assure you it would be very poor drainage you would get were it not for the joints you get in laying one foot tile. What water passes through the joints of a tile drain is about all you can expect to pass into the tile as the fine particles of soil seal all openings in the tile structure. It might do for filtering purposes but for nothing else. Then don't let the man with his rough tile persuade you that they are as good or better than glazed tile are.

SIZE OE TILE.

What size tile shall we use? As we are on the summit we know to what extent our tile have to work; but as we go down stream further we have to contend with more water, for that which falls on the ground to be drained, and that which falls on ground above encumbers the capacity of tile and the outlet of a drain in many cases cannot work as soon as it would farther up the stream, as the water from above may keep open ditches or even running streams full for several days, and in such case you will necessarilly need larger tile than where you have a free and unobstructed outlet. I will try and give you a table that will suit for most of the ordinary outlets.

TABLES OF CAPACITY OF TILE AS OUTLETS OF CONNECTING BRANCHES.

2 inch tile drains,	1 acre.
3 " " "	2½ acres.
4 " " "	4 "
5 " " "	6¼ "
6 " " "	9 "
7 " " "	12¼ "
8 " " "	16 "
10 " " "	25 "
12 " " "	36 "
14 " " "	49 "
15 " " "	56 "
16 " " "	64 "
18 " " "	81 "

24	"	"	"	143	"
30	"	"	"	250	"
36	"	"	"	324	"

This will be very near the capacity of the tile, though condition of locality may change the estimate and make it too high or too low.

THE SURVEY.

Is it necessary to have a survey to locate a good tile drain? No, not unless there are several disagreeing parties who have land along the route of the drain, or want to drain into the same. But I want to say to you, you had better compromise the matter and make the drain without a survey, as the expense of making the drain will have to be made after all contending is over. Let each one do his or her share and it will be a lasting good to all concerned. If you cannot agree then try for an arbitration and agree to stand by the decision. Have such agreement in writing placed before the arbitrators, signed by all parties concerned, agreeing to accept the decision of arbitration; have arbitrators to put agreement on record, also their decision, recording the same. Then if any party wishes to engage in constructing the ditch it may be necessary to have a surveyor, if there is still some dissatisfaction, to set each share apart with depth of grade. This will be about the best way of disposing of the work. Then have the surveyor to make a plot of each

man's share or give each man a separate plot of his share. Thus you will have the plot of your own construction at hand always to refer to.

The division of the drain can also be made by the arbitrator if all parties are agreed to have them stake it off. But if they say each one shall do so much work, it must be surveyed.

WHAT SHALL WE AVOID IN TILE DRAINING?

The first thing to avoid is a willow tree, the roots of which will sometimes reach a tile drain four rods from the tree. Elm trees are equally as bad; white and black ash also are bad to choke tile drains by sending their fine roots into the tile drain at the joints. Almost any tree is that grows well on wet land, as they seem to naturally seek the water level and they can find this in the bottom of a tile drain. Right here to depart a little from the text, such trees are very dangerous about foundation walls of buildings. They often root in among the morter of such walls and crowd the stones out of their place in the wall. Fruit trees are not liable to do this so much as the trees of the forest. Fruit trees are not likely to injure tile drains as they do not seek after a water level, but rather prefer to remain in a dry soil. There is no instance of any trouble in tiling an orchard to my knowledge. I have tiled within ten feet of a row of apple trees along my orchard to reach my garden with a tile drain and have never had any trouble with that

drain in seven years, and I know where drains have been put in not more than five years ago that were put that near to ash trees that they had to be taken up and were found full of roots. Where you have to pass through timber of this kind, you should never use less than five inch tile. If the outlet is kept open it will then be too dry for them to send their roots into the tile.

WHAT WE SHOULD REMEMBER IN TILE DRAINING.

We should first look up the true line of the main drain, measure it and level it to have it all correctly proved the best line and the least expensive. A little time spent in overlooking the situation is never lost.

We next should remember to grade our ditches. The first thing we do is in cutting the soil away with a short spade, it is much easier done by scooping out the loose dirt and see that the water all flows freely. Then you can make your drain of an exact depth.

Next remember to lay your tile of the same size first, and take the shrunken ones of that size and lay them back and use them up the drain where you want smaller tile, as to lay three inch tile and when you have one burned very hard that is only two and one-half inches you would reduce your three inch tile to two and one-half by using the shrunken tile.

Lay all tile as close as possible. Leave no uncovered cracks. Leave no holes in bottom of

drain. Remember that tile laid in straight lines work best. Remember that sinks or miry swamps, or quicksands must have long narrow boards that are good and solid laid in the bottom before tile is laid in any soft and bottomed ditches. Tile should be more than one foot in length. In draining a swamp all soft and miry places must be tiled to save the crop and beasts.

Don't use straw, hay or corn stocks to cover tile. They will dam the water from the tile.

Cover your tile with the surface soil and then with bottom soil. Remember to use plenty of bricks or broken tile to mark your drains. Broken tile of good quality can often be had for hauling from the tile kiln. Mark deep and well, as good marking will make you a good drain plot, one to last forever.

Remember, too, that to have the best drainage your tile must be laid perfectly and have ventilation or air at the upper end to flow freely.

Remember to have the best flow you must have good smooth tile inside, though some rough material may sometimes be stronger than the smooth is. If you lay rough tile, clean the inside. But if you can get good glazed tile they are the best. The writer trusts that you will be able to drain successfully after reading this column.

HOW TO LOCATE OLD TILE DRAINS.

You can also locate your old tile drains and

mark them in this way very closely. All you have to do is to start near the outlet, just as soon after a rain as you see the plowed ground drying off over your old tile drains. Take a line, measure across the dry line of ground over the tile. Take one-half of the width and place a mark of about a half bushel of pounded bricks into the ground at this point, then go up this dry line to the first curve. Put in brick again after measuring as before. You should also put in some brick above and below the curve, making measurements every time. Go up your tile drain in this way and I will assure you that you will never vary more than a foot or so if you take correct measurements. Go up this line as far as you see dry ground. Mark at the upper end with several lots of brick, only a rod or so apart. This will give you a direct line to approach your tile drain from above; if you start above the drain and come down to the drain on this line, you will surely find your tile and your work is never lost. But if your drain don't work you cannot expect to mark them all right. But as far as they work all right you can do the marking all right, and some times where they only work partly by this you can also tell above ground where your tile works right. Now if you start out take your measure and stakes and you may mark the tile location first with stakes, then follow with pounded brick and shovel to mark where stakes mark the drain. When you

first begin to see the dry line on your plowed ground then is the best time to mark your tile drains.

Remember that a tile drain ever so well laid, if its outlet is not looked after and kept open it will not work well.

Remember that the straighter your tile are laid in line, the better the flow of the water.

Remember that it is cheaper to have a good tile drain than to lose your crop on untiled land, or in some cases to only have half a crop.

Remember it is cheaper to have tile drains in your swamps, than to swamp stock.

Remember it is cheaper to have tile drains than have your field full of plowed out ditches to run your machinery over and break them, as the money lost in this way would often make your tile drains.

Remember it is cheaper to make tile drains than to have your field full of plowed out ditches and have your stock roll in and die.

Remember a sheep lost in this way, if sold would buy many tile.

Remember a good colt or a good horse lost in this way would be something; if sold would go far towards tiling a farm.

Remember, if you could not sell that horse from your farm, that to have used the money that was required to buy another horse, would have gone far towards tiling your farm, and would have saved your horse, saved crossing ditches and

breaking your machinery and vexation; instead of having nice, even fields to reap over and an abundant harvest to reap.

Remember that if you must have field ditches, take a road grader and make them. They will not wash out like plow ditches, but they are still dangerous to stock if made very deep.

Remember that too deep spading occasionally will make a soft slushy bottom to lay your tile in, and your tile will never work perfectly. Have a perfectly solid bottom, evenly graded and you have a good job.

Remember, oh remember last of all, to see to it that all your tile are laid right and never let job work, but better pay by the day and have your tile all laid an even depth. If tile are laid in a ditch and water partly covers them, they will be likely to fill up to the water, and you pay for work half done. Don't let tile be covered before you see them, if possible.

Remember it is when you have no places on your farm that are too wet to produce any crop that it is then that by good culture you can bring your farm to the highest state of productiveness of your locality.

CHAPTER ON DITCHING TOOLS.

The numbers designating the different draining tools, and the numbers of the descriptive paragraphs correspond.

1. Surface Spade Shovel, to be used in starting and grading water level.

2. Flat Cleaner should be used in grading to first water level.

3. Round Cleaner, to be used in absence of Flat Cleaner.

4. Push and Pull Cleaner, to be used in the bottom of drain to level tile drain bottom before laying tile.

5. Square Cleaner, to be used in laying Square Sewer pipe.

6. Flat Cleaner, to be used in removing all ground that falls back into ditch, and in making the first level. Also to be used in marshy, swampy land where you have to lay boards in the bottom of the ditch before laying the tile.

7. Drain Spade, the most useful in all drains except where roots interfere.

8. Ordinary Ditching Spade, to be used in rooty ground; also very good in swamps where roots may occur and you have to lay boards in the bottom.

9. Post Hole Spade, not wanted for ditching.

10. The Ordinary Spade is not very good in ditching.

11. The Ordinary Shovel, is not of much use in ditching.

12. To sum all up, about all that is needed for willing hands is a Surface Spade, Shovel and Round Push and Pull Cleaner. This is about all generally needed except where roots interfere. Then use the Ditch Spade.

The Ditch Spade is intended for open ditches. In buying those tools get the best and lightest. You can get the weight on in mud, and clumsy, heavy tools are tiresome. I give you this to tell you what to get and don't let your dealers put no you other tools than those recommended.

Hussey, Binns & Co., Linard, Pittsburgh, Pa., have favored me with these plates and I am thankful to them. With these illustrations I think I can tell you what you want and what you don't want.

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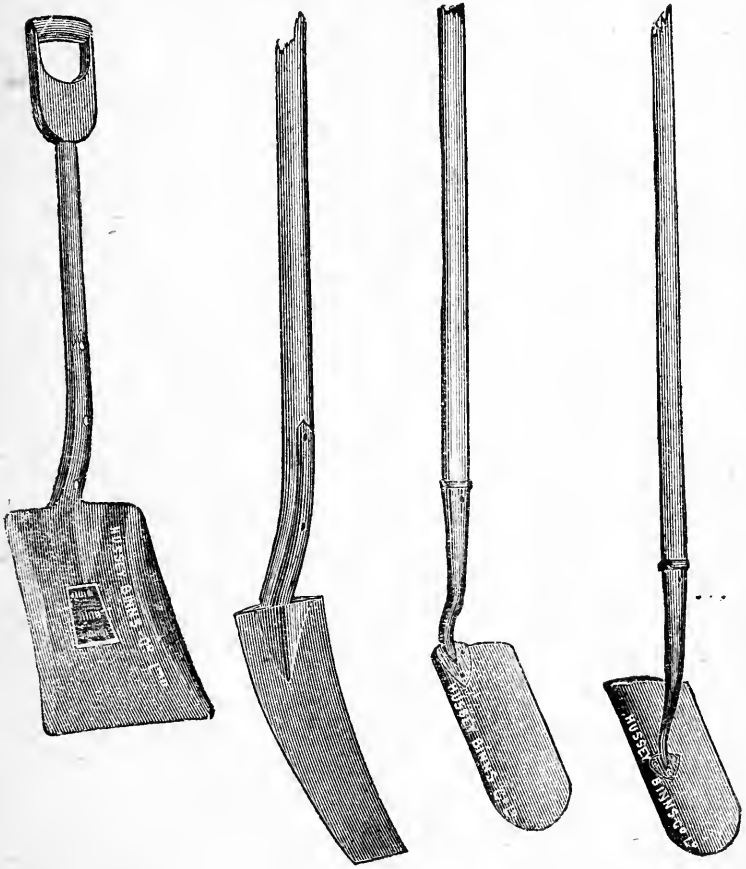

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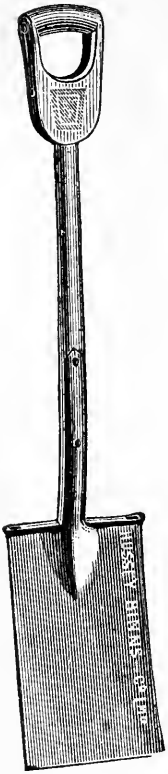

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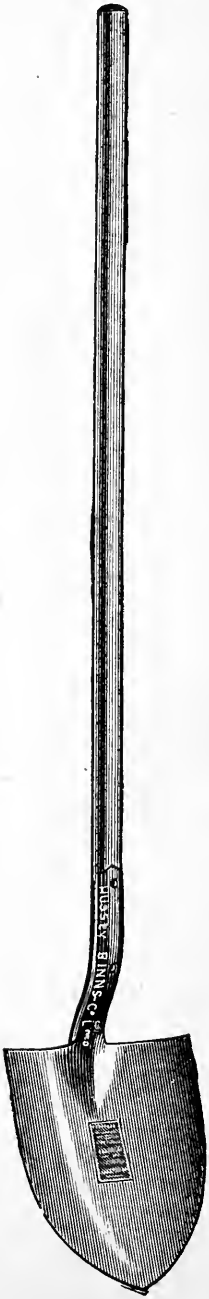

CLOVER FOR FERTILITY.

The importance of frequent clover seedings is too often overlooked by many farmers, especially if they do not grow clover seed themselves. Clover is not directly a money crop. It may be sold, but we pity the farmer who grows it for this purpose. Its best use is for feeding to stock on the farm, making manure that is worth nearly as much as its price in the market. Thus considerable time is required to bring a clover crop into money. Capital also is needed to purchase or even to breed the stock to be fed. Thousands of farmers every spring neglect sowing clover seed, or sow it in such small amounts as not to get much benefit from it. They do not have money to spare to buy clover seed, when there is such indefinite prospect of getting it back the same season. Probably in nothing is lack of capital in farming more injurious than in preventing frequent and liberal seeding of clover. Going into debt for clover seed is not necessary. A good seeding costs not much more than a dollar an acre. Nothing else comes as cheap as this, and nothing costing twice as much keeps fertility as clover does.

Ten to twelve pounds of clover seed are enough

if the soil is in good condition as to tilth. This will give more plants on a square foot than can grow to full size, but it is better to seed thickly, so as to suppress weeds. If the soil is very weedy it is better to sow a peck per acre than to have partial failure anywhere, and this at present prices might cost $1.25. Before midsummer this clover seed will have attained a growth more than enough to pay the cost of seed. It will usually pay to sow clover seed at anything less than $8 or $10 a bushel on spring grain, whose stubble is to be plowed for wheat in the fall. It is not merely the bulk of clover growth that makes this pay. The clover has, if successful, suppressed many weeds, and it is worth much more as a fertilizer then they could be.

Let this clover grow through two seasons, and how much has it benefited the soil in that time? The roots have pushed into the subsoil so far as the vigor of the plant and richness of soil above will allow. Successive clover crops penetrate the soil deeper, until it will in drained land reach down to shallow drains two or two and one-half feet deep. It is for this reason better to put underdrains down three feet at least, so that successive clover crops may not finally reach into them and choke them. No permanent injury is likely to occur to drains from clover roots. As soon as the plant dies the root quickly dissolves, and is washed out by next winter's

or spring's floods. The track of the clover root in the subsoil makes a water course for surplus water to filter through to the drain. Clover and underdraining thus each help the other.

If all small grains were seeded with clover at every crop there would soon be no complaint of the scarcity of manure to fertilize the farm. If a part of all the manure applied is used in growing clover, it will so rapidly increase the capacity of the farm to keep stock that there need be no lack of manure thereafter. Without such clover seeding it is impossible to grow grain crops without making the land sterile, even though commercial fertilizers be ever so abundantly used. With clover seeding as often as possible, so much of all manure is returned to the soil that it can not help increasing in fertility and this too without plowing under any part of the clover crop except its roots.

So far as possible, farmers should grow clover seed. In growing the second crop after the first has been cut for hay, the grain in soil fertility and also in the depth of the clover root is greater than during any previous equal length of time that the plant is growing. Part of the clover seed is generally dropped on the ground in gathering it, but this is by no means wasted. Land where clover seed has been often grown becomes so well seeded that it will grow a crop of clover every time the field is plowed for several years thereafter. Farmers sometimes say that

such land is "natural to clover," which is a mistake if it means that clover grows without seed. But such land is always regarded as among the best, because it has long been in the hands of farmers who appreciate the value of clover.—The American Cultivator.

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